NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

AN ANALYSIS OF THE STANDARD DEPOT LEVEL MAINTENANCE (SDLM) PROGRAM OF THE F-14 TOMCAT

by

Craig J Washington

June, 1996

Principal Advisor: Donald Eaton
Associate Advisor: Jane Feitler

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE June 1996	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE AN ANALYSIS OF THE STANDARD DEPOT LEVEL MAINTENANCE (SDLM) PROGRAM OF THE F-14 TOMCAT

5. FUNDING NUMBERS

6. AUTHOR(S) Craig J. Washington

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Postgraduate School
Monterey CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

Since 1991, the cost and schedule of the F-14 Tomcat Standard Depot Level Maintenance (SDLM) Program has doubled. Additionally, the requirements for In-Service Repair (ISR) have grown at a exponential rate as SDLM deferrals from the Aircraft Service Period Adjustment (ASPA) Program have caused the material condition of the aircraft to deteriorate and the need for depot-level field team rework to become increasingly demanded. As the cost of SDLM and ISR have grown, the number of aircraft overhauled each year has decreased. Recent efforts to decrease the scope of the SDLM Specification, or work breakdown, have not reduced this trend. The 1996 Preliminary SDLM Specification further reduces the depot's requirements placing more work into the hands of organizational level sailors, without compensating these units with additional manpower.

This cycle will continue and the cost for SDLM and the need for ISR will grow to the point where the aircraft will no longer be cost effective. In the meantime, our organizational units will continue to strive to maintain the aircraft to an acceptable level while additional workload is placed on them taking advantage of free sailor labor. This research shows that the present course will lead the aircraft to a cost effectiveness termination far short of the 2010 goal, while placing an undo burden on our organizational units.

14. SUBJECT TERMS: SDLM, ASPA, In-Service Rework (ISR)

15. NUMBER OF PAGES: 51

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18 298-102

Approved for public release; distribution is unlimited.

AN ANALYSIS OF THE STANDARD DEPOT LEVEL MAINTENANCE (SDLM) PROGRAM OF THE F-14 TOMCAT

Craig J. Washington
Lieutenant, United States Navy
B.S., U.S. Naval Academy, 1989

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1996

Author: ______________________
Craig J. Washington

Approved by: ______________________
Donald Eaton, Principal Advisor

____
Jane Feitler, Associate Advisor

______________________ for
Reuben Harris, Chairman
Department of Systems Management

ABSTRACT

Since 1991, the cost and schedule of the F-14 Tomcat Standard Depot Level Maintenance (SDLM) Program has doubled. Additionally, the requirements for In-Service Repair (ISR) have grown at a exponential rate as SDLM deferrals from the Aircraft Service Period Adjustment (ASPA) Program have caused the material condition of the aircraft to deteriorate and the need for depot-level field team rework to become increasingly demanded. As the cost of SDLM and ISR have grown, the number of aircraft overhauled each year has decreased. Recent efforts to decrease the scope of the SDLM Specification, or work breakdown, have not reduced this trend. The 1996 Preliminary SDLM Specification further reduces the depot's requirements placing more work into the hands of organizational level sailors, without compensating these units with additional manpower.

This cycle will continue and the cost for SDLM and the need for ISR will grow to the point where the aircraft will no longer be cost effective. In the meantime, our organizational units will continue to strive to maintain the aircraft to an acceptable level while additional workload is placed on them taking advantage of "free" sailor labor. This research shows that the present course will lead the aircraft to a "cost effectiveness" termination far short of the 2010 goal, while placing an undo burden on our organizational units.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

In order to fully comprehend the scope of this thesis, I will first describe how the F-14 overhaul program has developed into its present state. Next, I will describe recent changes to the specification that have taken place and the impacts of the Aircraft Service Period Adjustment (ASPA) Program over time.

The Standard Depot Level Maintenance (SDLM) Program is defined as "Depot Level aircraft maintenance accomplished upon attainment of a specified number of calendar months and/or flight hours of service as designated by OPNAVINST 3110.11." The F-14 Tomcat was introduced to the fleet in the early 70's. It was initially designed to have an Operating Service Period (OSP) of 36 months based on engineering design parameters set forth by the original equipment manufacturer, Grumman Aerospace. The OSP is determined based on systematic analysis of airframe, systems and component design, operational performance, and Reliability and Maintainability (R&M) data. The OSP for the F-14 was updated based on operational experience to 48 months, and then finally to the current 56 month figure in 1981. (SDLM Spec, 1992)

The Aircraft Service Period Adjustment (ASPA) Program was developed by Naval Aviation Logistics Center (NAVAVNLOGCEN) and put into place by 1983. This program involves an in-depth inspection conducted by depot level industrial engineers to determine if a SDLM is warranted. The purpose of this evaluation is to provide a means of determining the need, based on material condition, flight time, Period End Date (PED) and other factors,

to induct an aircraft for depot level maintenance. The objective was to save money by deferring Depot Level maintenance until the material condition of the aircraft warranted its induction to SDLM, thereby adjusting the basis from "on-time" until "on-condition." By applying the ASPA process, depot induction deferrals today have become routine. For example, there are three F-14A aircraft in NAS Oceana approaching ASPA 6. This equates to a 128 month OSP or over 10 years between overhaul.

In 1991, the Standard Depot Level Maintenance (SDLM) Program for the F-14 Tomcat cost an average of $1.87 Million dollars per aircraft. This process involved 154 structural inspections and 104 system performance checks. By 1993, the cost of SDLM had grown to an average cost of $2.65 Million dollars per aircraft. In 1994, the SDLM Specification, or "work package" was significantly reduced, requiring just 83 structural inspections and 39 system performance checks, only 47% of the work requirements previously done. Despite the reduction, the average cost of SDLM continued to grow to $3.24 million dollars by the end of 1994. The Preliminary 1996 SDLM Specification requires further reductions to 73 structural inspections and 29 system performance checks. The process will now cover less than 40% of the original overhaul requirements yet costs 60% more per aircraft, on average.

In-Service Rework (ISR) is a term used to describe depot-level maintenance performed by engineers representing the naval aviation depot. These personnel perform various functions including inspection, on-aircraft repair and any required depot-level

modification. These modifications include system upgrades and system capability improvements.

As the costs associated with SDLM have grown over the years, fewer and fewer aircraft have been inducted for overhaul. Since the budget associated with In-Service Repair competes for the same OM&N funds as SDLM, conflicts arise as to what use of the budget will be optimal. As the material condition of the Tomcat deteriorates and Depot-level modification requirements increase, an increasing need for ISR to be performed by Depot Field Teams has arisen. The result of these modifications has caused the budget for ISR to grow and previously budgeted SDLM "slots" disappear to free available funds for ISR.

The continued ASPA deferrals cause additional problems such as the changes in squadron workload resulting from preparing for and recovering from ASPA Inspections and the requirements of aging aircraft. Additionally, the recent reductions to the SDLM Specification have further exacerbated the situation by shifting work, once performed by depot artisans, down to the organizational level sailors. This represents not only an additional burden on the sailors, but the potential exists for even greater deterioration of the material condition of this aircraft due to the lack of technical expertise on vital systems.

This study will show that the present course of action will continue to cause increased growth to SDLM and ISR costs, while overhauling fewer aircraft each year. Additionally, the reduced SDLM Specification will cause even greater deterioration to the material condition of the aircraft as the skilled, Depot artisans will no longer be inspecting critical aircraft systems. Further, this study will provide justification that the Navy eliminate ASPA

from this vital platform, and drive the aircraft to a set Operating Service Period (OSP), in order to gain control of the cost and performance of the F-14 SDLM Program.

B. PURPOSE OF RESEARCH

The purpose of this thesis is to analyze the effectiveness of the present F-14 SDLM Program. It will examine the cost and schedule growth that has occurred despite having the SDLM "Specification", or work breakdown, reduced. It will examine the results of the SDLM Specification changes and their impact on the organizational unit maintenance requirements. Additionally, this thesis will show the impact of the present system in terms of increasing In-Service Rework requirements due to the ASPA Program, decreased SDLM specification, and deteriorated material condition of the aircraft.

C. SCOPE OF RESEARCH

This thesis will be divided into three major parts. First, an analysis of what workload has been shifted from the depot level down to the organizational level and its affect on our sailors and the material condition of the F-14 will be presented.

Second, the growth associated with In-Service Engineering/Repair for the F-14 will be analyzed and determine what cost growths are directly attributable to the work removed from the SDLM Specification.

Third, a historical cost analysis of the F-14 SDLM program, describing cost growth and ASPA deferral trends will be presented.

D. THESIS ORGANIZATION

Chapter II will analyze the modification to the SDLM Specification. This chapter will review the F-14 SDLM Specifications for 1992, 1994, and the preliminary specification for 1996. This chapter will additionally discuss the SDLM procedures used on the P-3 Orion and the E-6A TACAMO programs.

Chapter III will analyze the impact of the present policy with regards to the growth of In-Service Rework, additional workload burden on organizational units, and the deteriorated material condition of the aircraft.

Chapter IV will analyze the cost and schedule of the F-14 program from 1991 to the present. A discussion of the trends in budget costs, depot completions and ASPA deferral rates will be provided.

Chapter V contains the conclusions and recommendations for further study.

II. STANDARD DEPOT LEVEL MAINTENANCE (SDLM)

A. BACKGROUND

Naval Aviation Depots provide three general industrial functions. First, they are involved with the rework of aviation end items, systems and components. Second, they are involved in the manufacture of items and component parts otherwise not available or that are cost prohibitive. Third, they are involved with support services which include professional engineering, technology, and calibration services. The depot is responsible to support the organizational and intermediate level activities by providing technical assistance and carrying out those functions that are beyond the responsibility or capability of the O or I level activities through the use of more extensive facilities, skills and materials. Depot level services are carried out in depots, or in the field, by personnel representing the depot. It is in this light that the term 'depot' represents both a capability and a facility. (OPNAVINST 4790.2 series)

Rework of aircraft falls into three categories: maintenance, modification and special structural inspection. Maintenance functions are those required to maintain or restore the inherent designed service levels of performance, reliability, and material condition. It involves the complete rebuild through reclamation, refurbishment, overhaul, repair, adjustment, servicing, and replacement of system consumables. It also includes inspection, calibration, and testing. Modification functions are those required to change or improve design levels of performance, reliability, and material condition. Special structural inspections are performed by the depot to determine fatigue life computations, technical directive compliance

requirements and any inspections that can not be performed by the 'O' or 'I' levels due to a lack of skills, expertise or equipment. (OPNAVINST 4790.2 series)

The first F-14 requiring Standard Depot Level Maintenance (SDLM) was inducted into the Naval Aviation Depot (NADEP), Norfolk in 1975. In 1982, the SDLM effort became dual sited with NADEP North Island coming on line to perform the aircraft overhaul. In 1991, F-14 depot maintenance was single sited back to Norfolk. NADEP North Island completed its last SDLM overhaul on 26 April 1992. In 1993, the Base Realignment and Closure Committee (BRAC) decided to close NADEP Norfolk. The F-14 SDLM is currently being transitioned to NADEP Jacksonville, having inducted their first Tomcat on October 1, 1994. Today, the last few remaining F-14's are finishing their overhaul in Norfolk. Meanwhile, NADEP Jacksonville completed the prototype F-14 SDLM on 16 Jan 1996. (Nixon, 1996)

The multiple changes to the Depot location have no doubt assisted in the increasing variability that plagues the Tomcat SDLM process. The effect of a "learning curve" has been prevented from becoming fully optimized due to the various changes to the flow, work content and demand. The effects of these changes will be further addressed in the cost analysis portion of this thesis.

B. THE SDLM SPECIFICATION

The SDLM Specification is a document that establishes the overhaul requirements for naval aircraft. These requirements are determined based on systematic analysis of airframe,

systems and component design, operational performance, and Reliability and Maintainability data. The SDLM process is expected to identify material deficiencies and to correct such deficiencies so that the aircraft can be maintained at the organizational or intermediate level with assurance of a high level of operational availability throughout the next Operating Service Period . (SDLM Spec. 1992)

In 1994, the SDLM Specification "coverage" verbiage was amended to read "correction of deficiencies shall be at the lowest authorized maintenance level in accordance with OPNAVINST 4790.2 series VOL I, Chapter 3. Correction of Depot Level deficiencies shall be corrected by the most economical means available." This amendment to the scope of the SDLM Specification was the first step in a significant cost savings drive to regain control over the Tomcat SDLM process by shifting various overhaul requirements down to the "sailor" level.

C. SDLM SPECIFICATION REDUCTION

The 1992 SDLM Specification included 154 structural inspections and 104 system performance checks. The 1994 SDLM Specification reduced the number of structural inspections to 83 and the system performance checks down to just 39, only 47% of the work requirements previously performed. The responsibility for the upkeep of those areas no longer covered under the modified SDLM Specification was shifted down to the organizational level. It is clear at this point why the "SDLM coverage" section was amended to read the statement regarding the "lowest authorized maintenance level". What is not clear,

is whether or not we are to infer that the "most economical means" represents "free" organizational level sailor effort.

The proposed 1996 SDLM Specification calls for further reductions to 73 structural inspections and 29 system performance checks, only 40% of the work requirements performed in the 1992 specification.

D. CONSEQUENCES OF A REDUCED SDLM SPECIFICATION

There are two distinct "schools of thought" on the consequences of a reduced SDLM Specification that are in diametric opposition to one another - those that endorse a reduction, and those that oppose it.

For those that endorse a reduction, there is the belief that in the past, NADEP's performed extensive organizational level repairs and preventative maintenance beyond the SDLM Specification. This not only drove up costs and Turn Around Time to unacceptable levels, but created a climate in which squadrons routinely deferred maintenance until SDLM, which further exaggerated the problems and additionally lead to reduced experience levels in some areas. Given the reduction to DOD budgets and an era of downsizing, current funding levels will no longer support this level of effort, and the discrepancies that require less than Depot level capability must be passed on to those units capable of performing the effort. (Nixon, 1996)

In opposition to this reduction "school of thought" are the organizational level units and the functional wings. For these units, the shift in requirements adds an additional burden

to already undermanned and overworked squadrons. The reduced SDLM Specification places the responsibility for the upkeep of vital components into the hands of the sailors. For these units, it makes no difference what level of maintenance was initially determined to have the capability of repair, it is that the work has never been performed by these units which leads them to question the change. The necessary skills have not been taught, used or challenged and therefore are susceptible to error. For these units, primary concerns rest in the following areas:

1. Wing Area and Flap/Slat System

    - 13 Structural Inspections cut out of 25

    - 12 System Requirement Checks cut out of 17

2. Environmental Control System (ECS)

    - 18 System Requirement Checks cut out of 29

3. Fuel System

    - 16 System Requirement Checks cut out of 20

4. Landing Gear System

    - No longer inspected. 12 System Requirement Checks cut

These systems are consistently on the list of top ten readiness degraders as published by Fighter Wing Atlantic in NAS Oceana, VA. (Stephens, 1996)

E. IMPACT OF ASPA ON THE SDLM PROCESS

The impact that ASPA is having on organizational level maintenance is also significant, though it is extremely difficult to accurately quantify the magnitude of this burden. As discussed, the Navy has changed the procedures for depot level maintenance due to ASPA and a reduced SDLM Specification, but no changes were made at the organizational or intermediate levels. Maintenance data does not reveal or code time expended by the squadron to prepare for and recover from ASPA evolutions. Squadron maintenance personnel schedule ASPA evolutions concurrent with other scheduled maintenance to reduce aircraft down time to a minimum. Discrepancies noted and corrected during the preparation for an ASPA inspection are lumped in with the other scheduled maintenance being performed. Countless man-hours are expended "cleaning the aircraft up"of minor material condition discrepancies to avoid a "hit" on an ASPA inspection. The results of the ASPA inspection are forwarded to the functional wing for their review, which provides a quick analysis of the quality of the maintenance being performed by the squadron. It is, therefore, in the best interest of the squadron to "groom an aircraft" by correcting material condition discrepancies prior to its review by the ASPA inspectors. Again, the man-hours involved in this evolution are not normally coded which would enable us to see a clearer picture of the actual workload being performed. In any case, there are hundreds of man-hours spent each year in squadrons because of ASPA evolutions that could be spent in other capacities.

As the F-14 continues to age with only a handful of aircraft being overhauled yearly, the number of ASPA inspections performed each year increases. The functional wings

attempt to spread the quality of aircraft out throughout the respective squadrons, but there is little that can be done to slow the aging process. As the age continues to rise, the material condition of the aircraft deteriorates. Squadrons are now forced to perform depot level maintenance with only organizational level expertise. As the ASPA deferrals increase, and the material condition of aircraft inducted into SDLM deteriorates, this creates additional SDLM workload and places a burden on the depot. The depot now has to correct the work performed by organizational level technicians who do not posses the depot skill or expertise to perform the work.

The ASPA program, as a whole, has had a significant impact on both the organizational and depot level maintenance in terms of materials, scheduling, turn around time (TAT) and parts support by increasing the variability of the process. The ASPA program makes the planning and scheduling process extremely difficult at both the depot and organizational levels. There is a high degree of variability or uncertainty regarding the labor required, materials and the number of aircraft inducted into SDLM each year. With the ASPA process, there can be no established schedule for inductions each year. Therefore, no accurate planning or forecasting can be made regarding the number of SDLM's the depot can expect. (Legidakes/Ramsey,1994)

F. ANALYSIS OF HISTORICAL SDLM LABOR REQUIREMENTS

The following chart shows the average amount of labor hours spent performing an overhaul on the F-14 Tomcat. As **Figure 1** clearly depicts, the average labor requirements

YEAR	TOTAL HOURS	NUMBER OF AIRCRAFT	AVERAGE LABOR HRS
1991	288,492	12	24,041
1992	270,305	10	27,031
1993	410,048	14	29,289
1994	440,442	13	33,880
1995	Not Available	12	Not Available

Figure 1. F-14 SDLM Labor Requirements

per aircraft have continuously grown over the period covered, despite a significant reduction to the SDLM Specification in 1994. Unfortunately, no information was available for aircraft inducted into SDLM from 1995 until the present. Many of these aircraft have completed SDLM and have been delivered to their respective squadrons, but have not been financially completed, therefore the data is unavailable.

By contrast, **Figure 2** (below) provides labor requirements on the Air Force F-15 Eagle. This program is based on a Phase Depot Maintenance (PDM) cycle, performing its

YEAR	TOTAL HOURS	NUMBER OF AIRCRAFT	AVERAGE LABOR HRS
1991	279,208	34	8,212
1993	543,620	44	12,355

Figure 2. Air Force F-15 Eagle SDLM Labor Requirements

overhaul every 72 months. (Legidakes/Ramsey, 1994) Granted, the F-15 operates in a much more benign environment, but the physical attributes and age of the aircraft are very similar. The dramatic differences between the labor requirements and the number of aircraft overhauls performed each year clearly indicates the need for a change to our current overhaul policy.

G. ALTERNATIVE APPROACHES TO SDLM

The Navy recently began exploring alternative methods to the SDLM process. The P-3 Orion and the E-6A TACAMO programs are attempting to eliminate the ASPA process from their respective programs and are working with a strict Operating Service Period.

1. P-3 Orion

The Navy P-3 program began its initial analysis in 1989 for the Phase Depot Maintenance Program. In a 'phase depot maintenance system', aircraft are inducted into the depot for rework based solely on the number of calender months that have elapsed. The P-3 program was experiencing deteriorated material condition, rapid growth to ISR work, deteriorating ASPA results, and rapidly escalating organizational level man-hours. The P-3 is now inducted into the depot every four years, rather than one time in ten years as it was experiencing with the ASPA process. To change from one process to another, the program needed a transition period, which it received in the way of the Sustained Readiness Program (SRP). This program allowed the previous SDLM process to occur, while the phase concept was introduced to prototype aircraft. In the phase concept, the SDLM Specification had to be significantly overhauled to accommodate the new phase concept. Certain aspects of the

specification such as painting the aircraft needed to be performed every phase. Other aspects of the specification were modified such that various systems and components were allowed to go the entire twelve year period without being reworked. Again, these decisions were based on thorough review of Reliability Centered Maintenance concepts and analysis. This program is under continuous process improvement as the specification is being constantly reviewed to accomplish the goals of the entire P-3 Orion team. (Campbell, 1996)

The Commanding Officer of NADEP, Jacksonville has recently begun an initiative to help reduce the number of "noted, but not corrected" discrepancies on P-3's completing SDLM. "Noted, but not corrected" or NBNC discrepancies are items which are determined to be beneath the capability of the depot-level unit and therefore fall out of the category of "most economical means". The NADEP in Jacksonville is co-located with several P-3 organizational units. Taking advantage of this, the C.O. of NADEP Jacksonville has created a program that will allow organizational level maintenance personnel to visit the depot and correct the NBNC discrepancies as they occur. This system allows a full system, high quality aircraft to be returned to its parent command in a timely manner, without a "shopping list" of NBNC discrepancies for them to repair.

2. E-6A TACAMO

The Navy E-6A TACAMO program has implemented an overhaul program for its aircraft called the Enhanced Phase Maintenance (EPM) Program. The EPM program incorporates depot-level tasks into squadron scheduled inspections thereby eliminating traditional overhauls based on fixed time periods.

The implementation of the EPM program began in September 1993, with the first of three prototype aircraft. A one-year "test" period started in March 1994 which measured aircraft availability, mission capability and system performance rates, and monitored the material condition of the three aircraft. EPM was developed to limit down time on aircraft due to depot maintenance in order to avoid excessive "out of service time" causing a severe degradation to operations. This degradation was caused by depot inductions and a simultaneous extensive aircraft modification program. The effort not only improved aircraft availability, but also significantly improved the material condition of the aircraft and reduced organizational level maintenance man-hours. In some cases, total maintenance man-hours have been reduced by forty percent. Most of the maintenance man-hours are now expended during periods planned and set aside for maintenance. As a result, the maintenance effort is more predictable and the "well groomed" E-6A aircraft operates better and longer between failures.

The EPM program, as implemented in the TACAMO community, provides a very proactive maintenance methodology. It is primarily a reliability centered maintenance (RCM) based inspection program. Depot tasks are scheduled and performed based on RCM analysis and aircraft utilization. The most obvious benefit is the valuable insight into the aircraft's operating and material condition. This allows maintainers to focus on prevention rather than repair. (COMSTRATCOMMWING ONE , Feb 96)

As was the case in the P-3 example, the E-6A depot-level support is co-located at Tinker, AFB in Oklahoma City, OK. This provides ease in communication and rapid

response. This situation no longer exists in the case of the F-14 Tomcat due to BRAC '93. The aircraft will be single sited to NAS Oceana in Virginia Beach, Virginia, while the supporting depot is in Jacksonville, Florida. The traditional depot "paradigm" involves a process where the depot is a facility, containing only depot level manpower, tools and equipment. However, the P-3 and E-6A programs provide clear examples that the traditional SDLM paradigm must be examined for each platform. The overhaul program must be tailored to the unique requirements of the aircraft to include the restructuring of all three levels of maintenance to most effectively accomplish the mission.

H. PREVIEW

Chapter III will analyze the impact of the present policy with regards to the growth of In-Service Repair, additional workload burden on organizational level units, and the deteriorated material condition of the aircraft.

III. IN-SERVICE REPAIR

A. BACKGROUND

In-Service Repair (ISR) is a term used to describe depot-level maintenance work performed by engineers representing the naval aviation depot. These personnel perform various functions including inspection such as ASPA, on-aircraft repair and any required depot-level modification. These modifications include system upgrades and system capability improvements. This chapter will discuss the increases in the usage of this function and its affect on the organizational unit and the F-14 SDLM process.

B. THE USE OF IN-SERVICE REPAIR

Until 1994, the usage of In-Service Repair money was not tracked. Funds for this type of depot-level maintenance were set aside in a general industrial fund that also contained the SDLM budgets for all naval aircraft. The recent downsizing measures helped illuminate the problem associated with the tracking and usage of this "pot of money". Until 1994, these funds were issued out to each type command on an as needed basis. Should a shortfall occur toward the end of a fiscal year, funds were re-allocated from within the general depot program to include the use of SDLM dollars. On a recurring basis, aircraft SDLM overhauls have been cut in order to 'free up' available funds for ISR efforts. (Tuttle, 1996)

In-Service Repair funds are used to cover the expenses involved with the ASPA inspection process. Each ASPA inspection is composed of four to five depot-level engineers

who provide a general material condition evaluation of fleet aircraft to determine whether or not an aircraft should be considered for SDLM. As the number of aircraft in the ASPA deferral 'window' increases due to fewer and fewer SDLM's, the cost associated with providing this team of inspectors is growing .

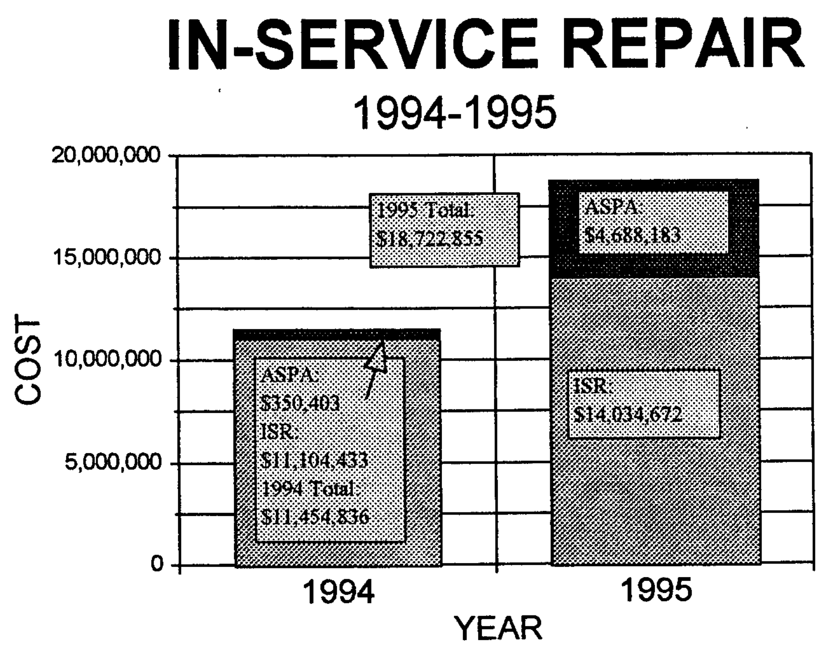

Figure 3. F-14 ISR Expenditures

The data from **Figure 2** was obtained from the Naval Aviation Depot Operations Center (NADOC) Aircraft Division. In 1994, the first year ISR was monitored by aircraft type/model/series (T/M/S), $11,454,836.55 was spent on the F-14 ISR effort. Of this, $350,403.80 was spent on ASPA. In 1995, $18,722,855.86 was spent on ISR, with ASPA accounting for $4,688,183.24. Again, the manpower and material requirements used by the organizational level in preparing for and recovering from these ASPA evolutions is not

accurately revealed. The "ASPA"costs in **Figure 3** are based solely on depot-level labor used in performing ASPA inspections and the costs of any required depot-level repair which was discovered during the inspection.

Why the costs associated with the ASPA process grew so significantly in 1995 cannot be accurately explained. The data for 1994 may not accurately include all of the true ASPA costs. To date, there is still no easy way of identifying ISR expenditures by specific aircraft bureau number. To determine what aircraft received ISR funding, you must look at ISR depot job orders and then search for which bureau numbers were affected. This process is extremely time consuming and can easily mask important data from being revealed. In order to see the true cost of an ASPA deferral, there needs to be a means of accurately assigning all costs to an individual aircraft that is in the ASPA deferral "window." Only then, will we be able to see the "true" costs associated with the ASPA process.

In-Service Repair funds also cover the costs of providing depot-level field teams who perform on-aircraft repair and modification. When an aircraft appears to have a discrepancy that is above the level of maintenance capability of the organizational level unit, a Planner and Estimator (P&E) Request is submitted via the functional wing to the NADEP. The NADEP then dispatches an engineer to the site of the aircraft to assess the need. Should depot level assistance be required, the NADEP then schedules a field team visit to the aircraft site to perform the required maintenance. There is a perception that too much "O" and "I" level work is being performed during these evolutions and precious ISR funds are being squandered. This simply is unfounded. All P&E requests must be approved by the functional

wing prior to being submitted to the NADEP. The functional wings determine what is within and what is above the maintenance capability of these units and organize the field team usage.

As the aircraft ages, and more SDLM's are deferred, the need for ISR work has increased. Additionally, there are various required depot-level inspections that must occur based on specific calendar related criteria. The 68 month Wing Sweep Pivot Bearing Inspection is one such inspection. This event requires extensive tear down of the aircraft that includes the removal of the wings. This inspection used to be performed in conjunction with SDLM, but the use of ASPA deferrals has caused this to change. The inspection is now being performed in the field at NAS Oceana. Events such as this require tremendous organizational level assistance in accomplishing the disassembly, reassembly, and quality assurance inspection of the respective systems. The sailor effort again is not accounted for, and the amount of man-hours are increasing significantly. For every ISR evolution, there will be a significant contribution by the organizational level in preparing for and recovering from the event. Just as in the case of the SDLM Specification reduction, these units are not being compensated with additional manpower.

As the trend continues, more and more burden is being placed on the organizational units. When questioned, the standard response is that the required work ultimately falls within the proper level of maintenance as per the appropriate regulation. What is not being addressed is the additional workload that has been increasing at an alarming rate with absolutely no forethought or evaluation.

C. PREVIEW

Chapter IV will analyze the cost and schedule of the F-14 program from 1991 to the present. A discussion of the trends in budget costs, depot completions and ASPA deferral rates will be provided.

IV. SDLM COST ANALYSIS

A. BACKGROUND

This chapter will provide cost data on the F-14 SDLM program from 1991 through 1995. During this period, the SDLM process was single sited at NADEP Norfolk. Therefore, this data should provide consistent trend information. The data for 1991 through 1993 was obtained from previous Naval Postgraduate School thesis research performed by LCDR Bob Ramsey, USN and LT Leo Legidakes, USN in December 1994. The data from 1994 until the present was obtained by the Naval Aviation Depot Operations Center (NADOC) Aircraft Division. As of the completion of this project, no aircraft inducted into SDLM for Fiscal Years 95' until the present had been financially completed and therefore were not available for review. All values presented are in 'then-year' dollars or man-hours. This section will discuss trends in budget costs, depot completions and ASPA deferral rates.

B. SDLM COST

Chapter II described the problems associated with the F-14 overhaul process with respect to the reduction to the SDLM Specification and the impact ASPA has had on the SDLM process. Chapter III described the increasing use of In-Service repair and its affect on the organizational level units. The problems associated with the F-14 SDLM Program can also be seen by examining the rising SDLM costs. The complete spreadsheet detailing estimated versus actual cost by bureau number can be reviewed in the Appendix. To facilitate

this thesis presentation, I have compiled excerpts from this information to show the trends over the past 6 years.

YEAR	Average Estimated Man-hours	Average Actual Man-hours	Average Estimated Materials	Average Actual Materials	Average Estimated Tot. Cost	Average Actual Tot. Cost
1991	17,829	24,041	$386,248	$421,405	$1,455,749	$1,872,574
1992	18,124	29,784	$401,468	$538,510	$1,547,937	$2,420,912
1993	18,338	29,289	$425,642	$564,500	$1,746,205	$2,672,225
1994	19,743	34,064	$425,767	$1,017,545	$1,590,266	$3,241,316
1995	20,585	N/A***	$591,712	N/A***	$2,301,683	N/A***
1996	28,807	N/A***	$792,531	N/A***	$2,150,080	N/A***

N/A***- denotes data not available

Figure 4. F-14 SDLM Cost Data

Figure 4 provides estimated versus actual figures for material cost, labor requirements and total cost for the F-14 Tomcat from 1991 to 1996. This data shows increasing trends in all of the above listed categories. Additionally the variance between what is estimated and what is actually occurring is worsening over time in all categories. This problem leads to annual 'cuts' to the numbers of aircraft inducted into SDLM which, in turn, leads to the exponential effect of increasing ASPA deferrals, aircraft age, ISR requirements, O-level workload and material condition deterioration. This variation can be seen graphically in **Figures 5** through 7 (following pages). This information clearly indicates a program that is out of control and deteriorating at an increasing rate.

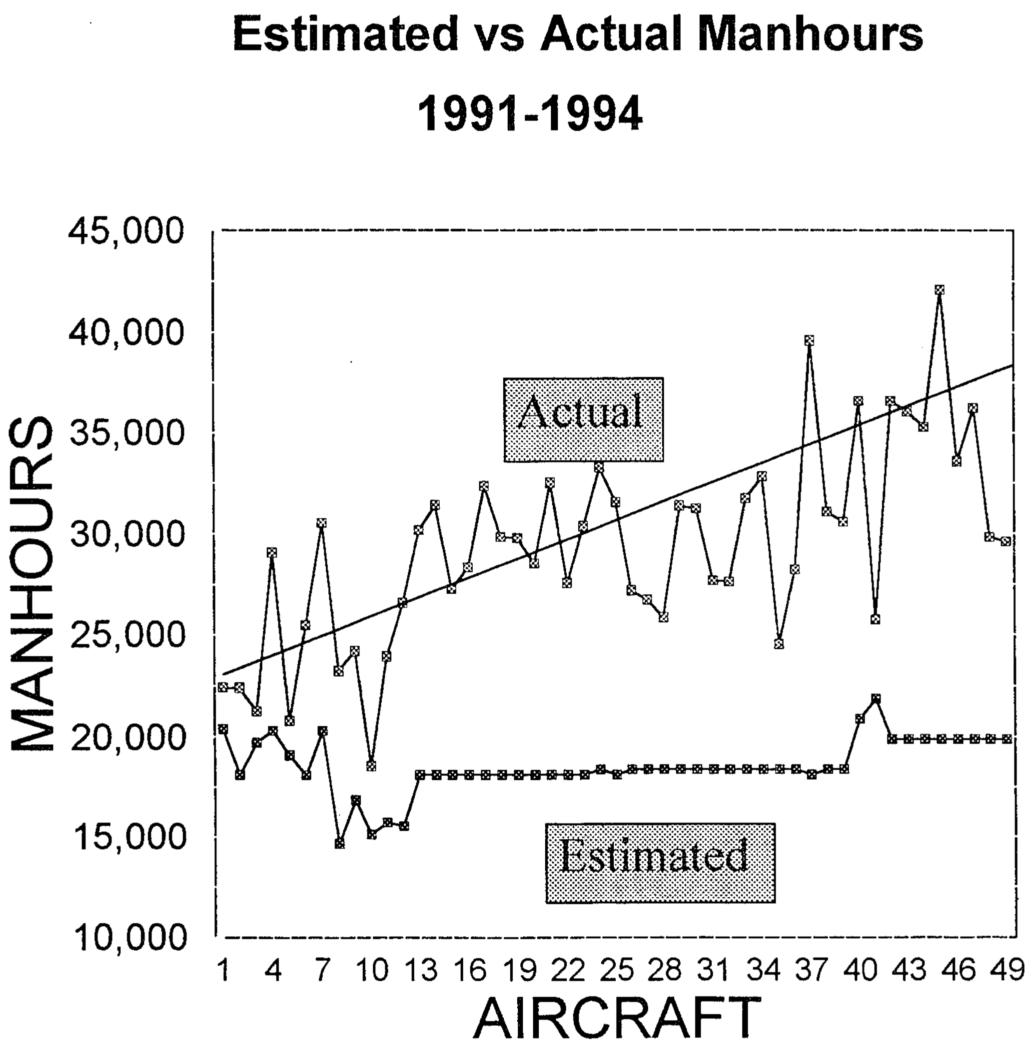

Figure 5. Estimated vs. Actual Man-hours

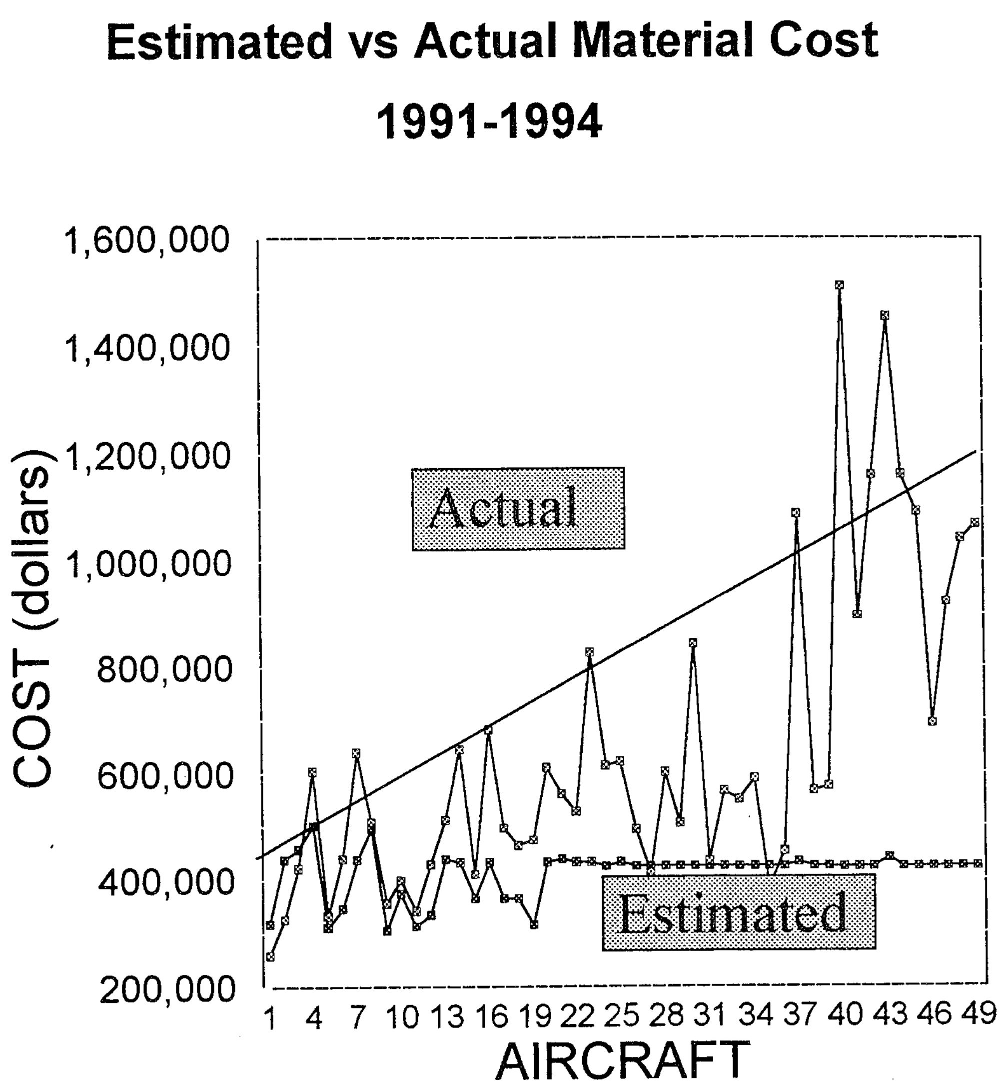

Figure 6. Estimated vs Actual Material Costs

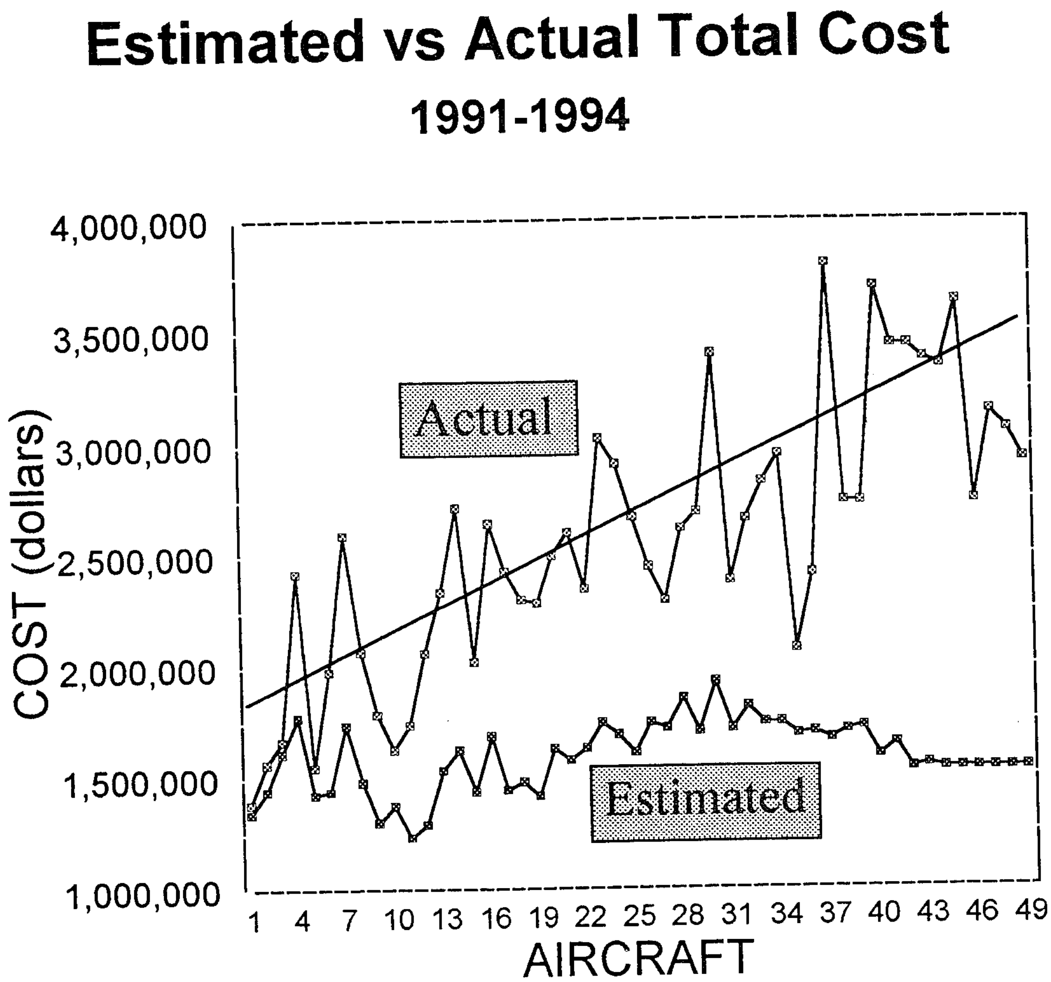

Figure 7. Estimated vs. Actual Total Cost

C. COST IMPACT

Over the next several years, the Tomcat community will reduce the number of F-14's to a core force of 250 aircraft, down from the present inventory of roughly 280. The term “core” is used to refer to those aircraft which are configured with certain systems that will provide the greatest future use to the naval aviation community. (Stephens,1996)

As the cost associated with SDLM rises each year, fewer SDLM’s will be able to be performed, and the number of ASPA deferrals will increase. As the average age of fleet aircraft grows, the amount of preventative and corrective maintenance needed to keep the aircraft at acceptable availability and capability rates will also grow. This trend, combined with a reduced SDLM Specification and increasing ISR requirements can mean only one thing - more work for the organizational level sailor. “Do more with less” was once a meaningless colloquialism used to describe how DOD activities needed to rid the waste and excesses of their respective organizations. Today, the phrase is more of an “albatross” hanging around our sailors’ necks and it’s rapidly undermining our readiness and national security.

V. CONCLUSIONS

A. FINDINGS

This thesis has described the present condition of the F-14 SDLM process. The analysis has centered on a decreased SDLM Specification, increasing ISR needs, and rising SDLM costs. The following can be concluded:

1. Increasing burden on our sailors

The 1994 SDLM Specification removed 53% of the depot level requirements. The Preliminary 1996 Specification attempts to eliminate an additional 7%, totaling a 60% decrease to the requirements of the original overhaul specification. The responsibility for the completion of these requirements has been shifted down to the organizational level units.

2. Increasing In-Service Repair Costs and Requirements

The requirements for In-Service Repair have increased at an exponential rate as the number of SDLM deferrals due to the ASPA program and the average age of the aircraft have increased. In 1995, the ISR budget for the F-14 alone was nearly $19 Million dollars, accounting for almost one third of the budget for ISR for all of naval aviation. As a result of the ISR cost growth, funded F-14 SDLM "slots" have been canceled further exaggerating the problems. The extensive use of depot field teams has created a very expensive "fourth" level of maintenance.

3. Increasing SDLM labor requirements

Despite the SDLM specification reduction in 1994, the number of man-hours required to complete an overhaul has increased by an average of over 9,000 hours per aircraft between 1991 and 1995.

4. Increasing SDLM costs

The total cost to complete an F-14 overhaul has increased by an average of over $1.3 million dollars per aircraft between 1991 and 1995.

The present policy will allow this cycle to continue while placing additional responsibilities and workload on the backs of our organizational level sailors. As the cost of each overhaul increases, fewer and fewer aircraft will be inducted into SDLM. The number of ASPA deferrals will continue to increase, as will the costs associated with In-Service Repair.

The F-14 'A' model aircraft are "programmed" to be in existence only until 2004, with the B's and D's lasting until 2010. The expectation is that the F-14 carrier deployment requirement will be reduced as F/A-18 E and F models will be available to deploy by 2004. Banking the future of the F-14 on the expectations of a replacement does not seem prudent. More likely than not, the F-14A's will still be making deployments long past 2004, and the need for B's and D's will be carried out into the future as well. The need for a change to the present SDLM policy is here. Before long, the average time between overhaul for the Tomcat may become too long, and the only course of action will be similar to our present

policy of expensive patchwork maintenance. Today, there is still time to change the way we do business.

B. RECOMMENDATIONS

The following are my recommendations to regain control over the F-14 SDLM Program:

1. Standardize Maintenance Procedures

The variability between aircraft can be addressed through strict adherence to standardization. Beginning this summer, all F-14's will be single sited to NAS Oceana, VA. This move will provide the opportunity to standardize the quality of maintenance being performed throughout the Tomcat community. This will also allow the functional wing at NAS Oceana to ensure a standard product is being input into the SDLM process.

2. Optimize the usage of SDLM and ISR Dollars

The cost and schedule growth of the F-14 SDLM program can be reduced by more efficiently and effectively allocating resources. Performing major depot-level work using ISR funds while the aircraft is in the ASPA deferral window is not cost effective. Recently, aircraft are even having frame 569 bulkheads replaced, a 2,700 depot-level man-hour effort, only to send the aircraft back out to the fleet to re-enter the ASPA process.

3. Drive the Aircraft to a Strict OSP

My recommendation would be to drive the aircraft to a strict Operating Service Period, concurrent to the need for major depot-level maintenance such as the 68 month Wing Sweep Pivot Bearing Inspection. This would extend the OSP out from the current 56

months, but it would be far shorter than today's fleet average of 90 to 100 months between overhaul. The "younger" aircraft will be in superior material condition and will require fewer "over and aboves" therefore driving down the cost per SDLM. This effort will, in turn, allow more aircraft to be inducted into the depot each year. The ultimate goal targets an overhaul to the entire fleet of aircraft every 68 months, instead of every 25 years as with today's pace.

4. Eliminate ASPA Deferrals

Clearly, it is not possible to institute a Phase Depot Maintenance (PDM) program in one sweep of the pen. There will be a critical transition period, as in the case of the P-3 and E-6A programs. The program change will take time and there will be a significant "learning effect" involved as trade-offs will have to occur between SDLM inductions and ISR requirements. By adopting a firm induction schedule, solely based on strict adherence to a specified operating service period, will provide a significant reduction to the major cost drivers now plaguing the F-14 SDLM process. This process will help to reduce the variabilities and uncertainties in turn around time, work schedule, manpower planning, and material requirements. Additionally, we will be able to alleviate much of the burden that has been placed on our sailors.

5. Use Innovative Methods to Improve the Process

Using the examples provided in the P-3 and E-6A cases, we need to look at ways to facilitate the depot process. NADEP Jacksonville could create a detachment of Tomcat trained organizational level maintenance personnel to correct O-level discrepancies as in the case of the P-3's. This becomes a manpower issue, but the downsizing of F-14 units should

be able to provide ample numbers of Tomcat trained maintainers looking for career enhancing shore duty. The F-14 community needs to break down the traditional SDLM paradigm, and think of depot as a "capability", instead of a "facility". This will allow creativity and innovation into the overhaul process allowing the Navy to achieve its operational goals more efficiently and effectively while preserving the usefulness of this highly capable aircraft.

C. FURTHER RESEARCH

This thesis attempted to quantify the costs associated with the F-14 SDLM process. The true cost of SDLM for each Tomcat must include the costs for the ASPA inspection process, In-Service Rework, and the increased workload on the backs of our organizational level sailors. Today, the costs associated with much of these processes are not clearly discernable. Future studies may examine how to improve these processes to more accurately reflect the true costs associated with ASPA deferrals. Additional research may examine the effects of restructuring our naval aviation depots to include organizational as well as intermediate level personnel in an effort to improve the efficiency and effectiveness of our F-14 overhaul process.

APPENDIX

							Est.	Act.							
1			Ind.	Est.	Act.	Var.	Mat'l	Mat'l	Var.	Labor	Est.	Act.	Variation		
	NADEP	BUNO	Year	Mhrs.	Mhrs.	lab(hrs)	Cost	Cost	Mat'l	Rate	Tot. Cost	Tot. Cost	Tot. Cost	tour	aspa
1	Norfolk	159017	1991	20385	22437	-2052	318333	258875	59458	50.27	1343087	1386783	-43696	4	
2	Norfolk	161147	1991	18124	22413	-4289	439208	325671	113537	55.37	1442734	1566679	-123945	2	1
3	Norfolk	161164	1991	19707	21263	-1556	457778	421740	36038	58.65	1613594	1668815	-55221	2	1
4	Norfolk	159454	1991	20311	29074	-8763	503000	604315	-101315	62.66	1775687	2426092	-650405	4	1
5	Norfolk	161150	1991	19101	20809	-1708	310269	332760	-22491	58.5	1427678	1550087	-122409	2	1
6	Norfolk	159457	1991	18097	25455	-7358	345553	439952	-94399	60.52	1440783	1980489	-539705	3	1
7	Norfolk	159606	1991	20311	30545	-10234	439208	639533	-200325	64.1	1741143	2597468	-856324	3	1
8	Norfolk	161281	1991	14675	23254	-8579	495697	509074	-13377	67.18	1481564	2071278	-589714	2	1
9	Norfolk	161850	1991	16846	24207	-7361	304581	355653	-51072	59.2	1301864	1788707	-486843	1	3
10	Norfolk	161853	1991	15114	18546	-3432	374522	399229	-24707	66.31	1376731	1629014	-252283	1	3
11	Norfolk	161857	1991	15742	23929	-8187	313214	341123	-27909	58.45	1233334	1739773	-506439	1	2
12	Norfolk	161861	1991	15531	26558	-11027	333617	428933	-95316	61.63	1290793	2065703	-774910	1	2
13	Norfolk	160389	1992	18124	30197	-12073	439208	511992	-72784	60.49	1535529	2338609	-803080		
14	Norfolk	160411	1992	18124	31433	-13309	432000	645358	-213358	65.99	1628003	2719622	-1091619	3	1
15	Norfolk	161868	1992	18124	27263	-9139	364420	410129	-45709	59.22	1437723	2024644	-586921	1	2
16	Norfolk	161860	1992	18124	28333	-10209	432000	681834	-249834	69.4	1689806	2648144	-958339	1	2
17	Norfolk	160386	1992	18124	32385	-14261	364420	497094	-132674	59.7	1446423	2430479	-984056		
18	Norfolk	160390	1992	18124	29848	-11724	364420	464568	-100148	61.63	1481402	2304100	-822698	3	1
19	Norfolk	161855	1992	18124	29790	-11666	315000	474388	-159388	60.84	1417664	2286812	-869147	1	2
20	Norfolk	161858	1992	18124	28516	-10392	432000	610794	-178794	66.24	1632534	2499694	-867160	1	2
21	Norfolk	161859	1992	18124	32540	-14416	439208	561667	-122459	62.82	1577758	2605830	-1028072	1	2
22	Norfolk	162604	1992	18124	27535	-9411	432000	527273	-95273	66.24	1632534	2351191	-718658	1	1
23	Norfolk	161284	1993	18124	30363	-12239	432000	826597	-394597	72.6	1747802	3030951	-1283148	2	2
24	Norfolk	161603	1993	18374	33269	-14895	424582	614948	-190366	69.04	1693123	2911840	-1218717	1	3
25	Norfolk	162600	1993	18124	31556	-13432	432000	621925	-189925	64.97	1609516	2672118	-1062602	1	1
26	Norfolk	162691	1993	18374	27179	-8805	424582	494002	-69420	71.98	1747143	2450346	-703204	1	2
27	Norfolk	162700	1993	18374	26702	-8328	424582	411899	12683	70.6	1721786	2297060	-575274	1	2
28	Norfolk	161607	1993	18374	25837	-7463	424582	602802	-178220	78.07	1859040	2619897	-760856	1	3
29	Norfolk	161609	1993	18374	31363	-12989	424582	506284	-81702	69.79	1706903	2695108	-988204	1	3
30	Norfolk	161621	1993	18374	31239	-12865	424582	843760	-419178	81.94	1930148	3403484	-1473336	1	3
31	Norfolk	162599	1993	18374	27664	-9290	424582	434861	-10279	70.44	1718847	2383513	-664667	1	2
32	Norfolk	162692	1993	18374	27606	-9232	424582	566071	-141489	75.98	1820639	2663575	-842936	1	3
33	Norfolk	160382	1993	18374	31750	-13376	424582	550492	-125910	71.91	1745856	2833635	-1087778	3	3
34	Norfolk	160407	1993	18374	32803	-14429	424582	590394	-165812	72.01	1747694	2952538	-1204844	3	2
36	Norfolk	162603	1993	18374	24522	-6148	424582	385524	39058	69.06	1693490	2079013	-385523	1	2
35	Norfolk	162693	1993	18374	28195	-9821	424582	453443	-28861	69.68	1704882	2418071	-713188	1	3
37	Norfolk	160403	1994	18124	39587	-21463	432000	1087946	-655946	68.5	1673494	3799656	-2126162	3	1
38	Norfolk	162597	1994	18374	31093	-12719	424582	567114	-142532	69.99	1710578	2743313	-1032735	1	2
39	Norfolk	162601	1994	18374	30579	-12205	424582	576028	-151446	70.77	1724910	2740104	-1015194	1	2
40	Norfolk	158637	1994	20894	36586	-15692	423699	1508618	-1084919	56.05	1594808	3698255	-2103447	3	1

							Est.	Act.						
1			Ind.	Est.	Act.	Var.	Mat'l	Mat'l	Var.	Labor	Est.	Act.	Variation	
	NADEP	BUNO	Year	Mhrs.	Mhrs.	lab(hrs)	Cost	Cost	Mat'l	Rate	Tot. Cost	Tot. Cost	Tot. Cost	tour
41	Norfolk	159444	1994	21878	25723	-3845	423699	897702	-474003	56.05	1649961	3444616	-1794655	
42	Norfolk	159845	1994	19878	36585	-16707	423699	1159940	-736241	56.05	1537861	3444412	-1906551	3
43	Norfolk	160396	1994	19878	36079	-16201	440517	1453587	-1013070	56.05	1554679	3384587	-1829908	3
44	Norfolk	160669	1994	19878	35279	-15401	423699	1161319	-737620	56.05	1537861	3353558	-1815697	3
45	Norfolk	160925	1994	19878	42101	-22223	423699	1091742	-668043	56.05	1537861	3636931	-2099070	2
46	Norfolk	161141	1994	19878	33561	-13683	423699	692752	-269053	56.05	1537861	2743268	-1205407	3
47	Norfolk	161274	1994	19878	36245	-16367	423699	922174	-498475	56.05	1537861	3148655	-1610794	2
48	Norfolk	162688	1994	19878	29811	-9933	423699	1041853	-618154	56.05	1537861	3067210	-1529349	1
49	Norfolk	162689	1994	19878	29597	-9719	423699	1067307	-643608	56.05	1537861	2932549	-1394688	1
50	Norfolk	159873	1995	19265	NA***		496612	NA***		78.95	2017584			
51	Norfolk	161421	1995	19265	NA***		496612	NA***		78.95	2017584			
52	Norfolk	161428	1995	19265	NA***		496612	NA***		78.95	2017584			
53	Norfolk	161432	1995	19265	NA***		496612	NA***		78.95	2017584			
54	Norfolk	141435	1995	19265	NA***		496612	NA***		78.95	2017584			
55	Norfolk	162916	1995	19265	NA***		496612	NA***		78.95	2017584			
56	Norfolk	162920	1995	19265	NA***		496612	NA***		78.95	2017584			
57	Jax	161162	1995	35106	NA***		1665080	NA***		88.02	4755110			
58	Jax	160910	1995	19265	NA***		489796	NA***		88.02	2185501			
59	Jax	161272	1995	19265	NA***		489796	NA***		88.02	2185501			
60	Jax	161856	1995	19265	NA***		489796	NA***		88.02	2185501			
61	Jax	162697	1995	19265	NA***		489796	NA***		88.02	2185501			
62	Jax	162917	1996	19265	NA***		489796	NA***		88.02	2185501			
63	Jax	161280	1996	28807	NA***		792531	NA***		46.95	2145020			
64	Jax	161294	1996	28807	NA***		792531	NA***		46.95	2145020			
65	Jax	162923	1996	28807	NA***		792531	NA***		46.95	2145020			
66	Jax	163221	1996	28807	NA***		792531	NA***		46.95	2145020			
67	Jax	161141	1996	28807	NA***		792531	NA***		46.95	2145020			
68	Jax	162919	1996	28807	NA***		792531	NA***		46.95	2145020			
69	Jax	163408	1996	28807	NA***		792531	NA***		46.95	2145020			

N/A*** - denotes information not available

LIST OF REFERENCES

Department of the Navy, *Operational Navy Instruction (OPNAVINSTR) 4790.2E, Naval Maintenance Instruction,* 1991.

General Administrative Message (GENADMIN), Commander Strategic Communications Wing One (COMSTRATCOMMWING ONE), Tinker AFB, OK, 231930Z February, 1996.

Interview between Jim Campbell, Captain, Commander Naval Air Systems Command, Assistant Program Manager for Logistics (APML), P-3 Orion, and Craig J. Washington, Lieutenant, USN, March, 1996.

Interview between Bob Nixon, Commander Naval Air Systems Command, Depot Operations Industrial Division, AIR-6.0B, and Craig J. Washington, Lieutenant, USN, March, 1996.

Interview between Al Stephens, Lieutenant Commander, Commander Fighter Wing Atlantic (CFWL Code 51), and Craig J. Washington, Lieutenant, USN, January, 1996.

Interview between Al Tuttle, Naval Aviation Depot Operations Center, (NADOC), and Craig J. Washington, Lieutenant, USN January, 1996.

Naval Air Systems Command, *Navy Model F-14A, F-14B & F-14D Aircraft, Analytical Maintenance Program Standard Depot Level Maintenance SDLM Specification*, by direction of Commander Naval Air Systems Command (NASC), September 1987, February 1992, June 1994, December 1995 (Preliminary).

Ramsey, Robert and Legidakes, Leo, *An Analysis of the Impact of ASPA on Organizational and Depot Level Maintenance*, Master's Thesis, Naval Postgraduate School, Monterey, CA December 1994.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center 8725 John J. Kingman Rd., STE 0944 Ft. Belvoir, VA 22060-6218	2
2.	Dudlley Knox Library, Naval Postgraduate School 411 Dyer Rd. Monterey, CA 93943-5101	2
3.	RADM Donald Eaton USN (Ret), Code SM/ET Department of Systems Management Naval Postgraduate School Monterey, CA 93940	1
4.	Prof. Jane Feitler, Ph.D., Code SM/FJ Department of Systems Management Naval Postgraduate School Monterey, CA 93940	1
5.	RADM William J. Tinston, AIR-04 Naval Air Systems Command Headquarters 1421 Jefferson Davis Hwy Arlington, VA 22243-5001	1
6.	RADM R. W. Smith, AIR-6 Naval Air Systems Command Headquarters 1421 Jefferson Davis Hwy Arlington, VA 22243-5043	1
7.	CAPT R. E. Wagner Director, Industrial Operations Division Naval Air Systems Command Headquarters 1421 Jefferson Davis Hwy Arlington, VA 22243	1

8. CAPT S. Hileman, N-88 | 1
Pentagon 4B546
Washington, D.C. 20310

9. CDR S. R. O'Conner | 1
F-14/Phoenix Requirements
Pentagon 4D366
Washington, D.C. 20310

10. CAPT D. Snodgrass | 1
Commander, Fighter Wing Atlantic
NAS Oceana
Virginia Beach, VA 23460

11. CDR P. Taylor | 1
Commander, Fighter Wing Atlantic
NAS Oceana
Virginia Beach, VA 23460

12. LCDR A. C. Stephens | 1
Commander, Fighter Wing Atlantic
NAS Oceana
Virginia Beach, VA 23460

13. LT Craig J. Washington | 1
23454 Coopers Lane
Worton, MD 21678